

doubt for crushing the food. Posteriorly to the gizzard the gut is grey and rather broad, winding round the large brown liver. The genitalia are somewhat ordinary, but rather curious for their bright colour, which suggested the specific name I have adopted. The albuminiparous gland and hermaphrodite duct are pale ochreous yellow, as is usual, but the gland has on one surface a large elongated patch of bright red, which does not remain well in alcohol. The ovotestis is large and irregularly globular, yellow-green in colour, with two blackish broad sulci. A strong ligament has its origin on the ovotestis, close to the beginning of the hermaphrodite duct.

It is perhaps this species that has sometimes been observed here and taken for a true *Aplysia*. Gosse, in his 'Naturalists' Sojourn in Jamaica,' p. 55, and Mr. E. A. Andrews, in the 'Johns Hopkins University Circular,' April 1892, both refer to the occurrence of an *Aplysia* (species not identified) at Jamaica.

Institute of Jamaica,  
Kingstown, Jamaica,  
Jan. 21, 1893.

XXXIV.—*On the Embryology of the Mites: Segmentation of the Ovum, Origin of the Germinal Layers, and Development of the Appendages in Ixodes.* By JULIUS WAGNER, of St. Petersburg\*.

OUR knowledge of the processes which take place in the ovum of the Mites during its development is very limited. The causes of this are to be found on the one hand in the small size of the object, and on the other in the properties of the ovum, such as the thickness of the chorion and the brittleness of the yolk when hardened in alcohol, owing to the largeness of the yolk-spheres.

*Ixodes*, upon which my investigations were conducted, is a comparatively convenient subject—in the first place since its development proceeds somewhat slowly, and, secondly, because its ova do not require any great amount of attention and develop very well without especial precautions. When an *Ixodes* has once begun to deposit its ova it no longer stirs from the spot, and takes no notice if disturbed, as is often the

\* Translated from the 'Zoologischer Anzeiger, xv. Jahrg., no. 399 (August 29, 1892), pp. 316-320.

case when clusters of the ova are removed for the purpose of preservation. The deposition of the ova is a somewhat lengthy process, and continues almost to the time when the young emerge from the first batches; one and a half months, however, are requisite for development (in the northern Caucasus). Towards the end of the period of oviposition the tick is surrounded by a mass of eggs, which is twice or even three times the size of its body.

This at first sight apparently paradoxical phenomenon is due to the fact that the ova are heaped together in a loose and not in a compact mass.

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1. **Segmentation of the Ovum** \*.—The segmentation of the ovum of *Ixodes* differs from what was previously observed in the case of the Mites, in that the cells in process of division do not at first pass to the surface of the ovum (as is the case in *Tetranychus*, according to Claparède), though the yolk does not divide at the same time (as was observed by Robin and Megnin in Sarcoptidæ), since I found in the yolk four and six cells in course of fission, and on one occasion nine with resting nuclei. The process of segmentation consequently belongs to the partially interlecithal type. In the end the cells pass to the surface and form the blastoderm; no cells remain behind in the yolk.

2. **Formation of the Endoderm**.—Although in the first stages of development differences are noticeable between the individual cells of the blastoderm, they are at all events not pronounced and are connected by transitions in such a way that it is impossible to describe them precisely: the conditions, however, soon change. Certain cells are distinguished by their large nuclei, which usually occupy an oblique position with reference to the surface of the ovum; these nuclei take a fainter stain from carmine than those of the ordinary blastoderm cells, and contain in their interior from one to two nucleoli, which stand out sharply and are not present in the nuclei of the rest of the cells of the blastoderm. In one and the same series of sections, but still better in series which follow one another in succession, we observe how cells of this kind recede from the surface into the interior of the yolk and how the surrounding cells of the blastoderm close up above them. These cells constitute the so-called yolk-cells. As

\* Before the segmentation I also observed the extrusion of two directive corpuscles; in *Ixodes* this takes place prior to the deposition of the ova.

regards the region where the yolk-cells are differentiated, no regularity whatever can be detected; they are formed over the entire surface of the ovum. At the same time, however, certain of these cells form a cluster on the dorsal side of the ovum nearer the posterior end. They appear not to participate in the formation of the yolk-cells, but represent the remaining portion of the endoderm.

3. **Formation of the Mesoderm.**—At the stage which immediately precedes the appearance of the appendages mesoderm cells become visible at the sides of the above-mentioned endodermal cluster. From this we see that although this group of cells, which in its position corresponds with the *cumulus primitivus* of the spiders, does not represent the sole spot where the endoderm cells are formed, on the other hand it is just here that the mesoderm cells arise, which extend hence over the posterior end of the ovum on to the ventral surface, and along this towards the front. As regards the nature of the origin of the mesoderm cells, I find by a careful examination of the sections that at this spot no division in a tangential direction takes place; that is to say, that we here get an immigration of cells. On each side of the cluster of endodermal cells we find upon the surface of the ovum in the early stages of the development of the mesoderm a furrow-like depression, at the bottom of which an active immigration of the cells takes place. These depressions appear to me to correspond to the lateral margins of the germinal streak of Insects (Heider, *Hydrophilus*).

4. **Segmentation of the Yolk.**—As I have already indicated, no division of the yolk is observable during the segmentation of the ovum. Nevertheless when fresh ova are examined the yolk in the stages of the development of the appendages does not present a homogeneous structure; on the contrary, it is differentiated into separate polygonal portions of large size, which are divided from one another by clefts. In later stages, when the appendages attain a considerable length, this appearance stands out with especial distinctness. I was able to detect it later on in sections also. Thus we see that the yolk, subsequently to the migration of the yolk-cells, which are present at first in inconsiderable numbers (about thirty), splits up according to the number of these into separate portions, which are still preserved in the intestine of the larva shortly before its escape from the egg.

5. **Development of the Legs.**—The germinal streak of the Mites, like that of the Spiders, at the stage of the appearance of the appendages takes up the greater portion of the circumference of the ovum, passing over on to the dorsal surface

with its caudal and cephalic lobes. At this stage it already consists of two ectodermal ridges, which are separated by a band of flat cells and meet together at the ends of the elliptical ovum. When examined from the side the appendages appear very sharply defined. In addition to the usual three pairs of legs, which are characteristic of the larvæ of most of the Acarina and especially of Ixodidæ, the fourth and last pair is also developed in the embryo\*. In the course of the development of the anterior legs this pair elongates and even exhibits an indistinct segmentation. Shortly before the larva is hatched it begins to degenerate rapidly; it decreases in length and becomes, so to speak, drawn in, so that soon no trace of it is left on the outside. But sections of the larva after its escape from the egg show that beneath the integument of the body on both sides, in the region of the transition of the mid-gut into the hind-gut (the excretory vesicle), there lies a cluster of cells, which represents the remains of the fourth pair of legs. From these clusters of cells also the fourth pair of appendages appears to develop on the transition of the larva into the nymph.

**6. Segmentation of the Abdomen and its Appendages.**—In the early stages of development the mesoderm consists of isolated groups of cells corresponding to the appendages; the mesoderm cells completely clothe the cavity of the appendages, but this cavity remains open to the yolk; the mesodermal elements are also localized in a similar manner behind the appendages, that is in the abdomen, since the fourth and last pair of legs must be regarded as appendages of the last thoracic segment. Behind the legs lie from five to six mesodermal groups. I did not determine their number precisely, because the sixth group passes quite gradually into the mesoderm of the caudal lobes. The internal segmentation in the region of the abdomen is consequently expressed through at least five segments. In the first segment, as in that of the thorax, the mesoderm lies in a layer; in the segments next following it forms a closed half-somite. Most developed are the second, third, and fourth segments, on each of which there is a projection on each side in the shape of a scarcely perceptible tubercle. These tubercles can only be observed in sectional preparations, and although they apparently do not develop into more noticeable protuberances, they yet without doubt represent structures homologous with the abdominal appendages of spiders.

**7. The Cephalic Appendages.**—I can positively assert that

\* Cf. Winkler, *Gamasus*, in no. vii. of Claus's 'Arbeiten.'

in front of the chelicerae (*cf.* Jaworowsky, *Trochosa*) in the case of *Ixodes* no rudiments whatever of appendages are present. If nevertheless we observe the early stages of the development of the appendages, it is not difficult to discover that between the chelicerae and pedipalpi there lies yet another pair of tubercles; consequently there are altogether three pairs of tubercles—a pair of chelicerae, a pair of pedipalpi, and a pair which is situated between the two former. This latter pair arises later than all the rest of the appendages, and, judging from its position, bears a close relation to the pedipalpi. This is proved also by sections, since they show that the mesodermal elements of this pair of tubercles form a direct process of the mesoderm of the pedipalpi. In subsequent stages no trace of the tubercles is to be found: I have not yet elucidated their significance.

XXXV.—*Description of a new Buprestid from Madagascar in the Collection of the Hon. Walter Rothschild.* By C. J. GAHAN, M.A.

*Chalcophoropsis Rothschildi*, sp. n.

Vividi-metallica; capitis fronte subplana, valde inaequaliterque punctata, supra inter oculos canaliculato-depressa; pronoto fortiter inaequaliterque rugoso-punctato, medio longitudinaliter sat profundeque canaliculato, utrinque ante medium plaga levi, atrovioacea, paullo elevata, in depressione magna flavo-pollinosa, posita; scutello invisio; elytris cupreo-purpurascensibus, nitidis; costis octo, paullo elevatis (quarum interna prope basin utrinque brevissima) et punctis foveolatis numerosis albo-fasciculatis, obtectis, lateribus prope apicem breviter denticulatis; corpore subtus dense foveolato-punctato et albido-fasciculato; tarsi postici articulo primo quam secundo manifeste longiore; antennarum articulis primo secundoque viridescensibus, tertio quartoque nigris, tertio quam quarto vix longiore, hoc apice intus compresso et dense punctulato (articuli ceteri desunt).

Long. 48, lat. (ad basin elytrorum) 15 mm.

*Hab.* S. Madagascar.

Head strongly and unevenly punctured in front, densely but much more feebly punctured behind; front rather flat below and with a median groove above between the eyes. Pronotum with a smooth dark violet and slightly raised area on each side just in front of the middle and about midway between the longitudinal groove and the lateral margin; this